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Application of geochemical model for monitoring the superviscous oil deposits development by the thermal steam methods

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Abstract

Heavy oil and natural bitumen deposits development is especially relevant nowadays. One of the highly efficient techniques for the development of such deposits is the steam-assisted gravity drainage (SAGD) method. This work has two main objectives. The first is to build the geochemical model of a deposit on vertical and horizontal gradients of the relative content of biomarkers. And the second is to assess the feasibility of applying the derived model to monitor the development of superviscous oil deposits in the Karmalskiy deflection of the Cheremshanskoye deposit, where the SAGD technology is currently applied. The experimental part of work consists of the extraction of 35 core samples from the 8 oil well pumps, extraction of the saturated factions from the bitumen and the gas chromatography-mass spectrometry (GCMS) analysis of the selected factions in the TIC mode. The relative concentration of 6H-Farnesol (HHF) to Phytane (Ph) was selected as a simulation parameter. Laboratory studies have shown that the HHF/Ph ratio is shown in horizontal and vertical gradients due to biodegradation of the organic matter throughout the whole studied area. It is also noted that in almost all wells there is a sharp increase in the HHF/Ph value at the bottom of the productive layer at a depth of 150 to 160 meters, where the most intense biodegradation of the organic matter occurs. Laboratory studies have shown that the HHF/Ph ratio is stable in the context of hydrothermal processing under pressure, which indicates that it can be measured in the superviscous oil produced by the SAGD method for subsequent comparison with the geochemical model. Based on the constructed model and measured HHF/Ph ratios in the extracted superviscous oil, authors have assessed the likely ways of its tributaries to the extractive wells.

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Keywords

6H-pharnesol, Biodegradation of oil, Gradients of biomarkers, Phytane, Steam-assisted gravity drainage (SAGD) modeling, Superviscous oil

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